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Congressional Hearings
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House Science Committee Holds Hearing on Tsunami Warning System Upgrade
LIST OF SPEAKERS

BOEHLERT:

The hearing will come to order.

The first order of business is to introduce to the audience and our colleagues on the committee the veterans and some of the newer members of the committee.

It's my understanding that the Democrats have just organized and the committee assignments were just made available late yesterday, so some of the newer members may not know their assignments just yet.

But on the Republican side, we are pleased to welcome Dave Reichert from Washington State, Mike Sodrel from Indiana, Michael McCaul from Texas, and Joe Schwarz, who will be joining us shortly, from Michigan.

I want to welcome everyone here today, especially our freshman members. This is the first Science Committee hearing of the 109th Congress and also the first congressional hearing on the administration's proposals for limiting U.S. vulnerability to tsunami.

It is unfortunate that it took a tragedy of staggering proportions to thrust this issue to the top of the congressional agenda, and indeed the whole world's agenda. But this newfound attention should help prevent future deaths, and that's the goal of today's hearing: to determine how the U.S. can best prevent future deaths, both at home and abroad.

The administration is to be applauded for coming forward quickly with a cogent, targeted and affordable proposal to improve tsunami detection for the U.S. and for its commitment to improve tsunami detection internationally.

But detection is only one piece of the kind of comprehensive effort that is needed to reduce vulnerability to tsunami. Warning systems, education, research and development, land-use planning and ecosystem protection are all necessary if any program is to be effective.

The administration acknowledges this, but Congress now needs to evaluate whether the January 14th proposal strikes the appropriate balance among those elements.

Shiny new technologies should not blind us to the need for a comprehensive approach.

Today's hearing must also address a number of other questions to help us develop a policy: How much risk does the U.S. actually face from tsunami, and how much would the proposed program reduce that risk? To what extent would the proposed program help save lives and property from a tsunami that was generated right off shore?

Will other programs be cut in the president's fiscal year '06 budget to pay for this new proposal? What precisely is the U.S. prepared to do to reduce the vulnerability to tsunami in other parts of the world? How can we best integrate the tsunami program with other hazard mitigation and research programs?

A lot of questions there, and that's why we're having this timely hearing to get some answers.

This committee has long experience in putting together efforts to improve the U.S. response to natural disasters. The National Earthquake Hazards Reduction Program, or NEHRP as we affectionately call it, which we created in 1977, has helped reduce the loss of life and property from earthquakes.

And indeed, NEHRP is an essential part of U.S. efforts to prepare for tsunami because most tsunami are generated by earthquakes.

We just reauthorized NEHRP last year and also created a similar program to respond to windstorms.

A lesson I draw from many years of experience with NEHRP is that any successful response program requires a comprehensive approach, strong interagency coordination and an unswerving focus to ensure that all programs will truly reduce the destruction wreaked by future events.

Another lesson I take is the centrality of the National Science Foundation to any successful effort.

I think all of our witnesses today mention NSF in their prepared testimony. And I hope the key role of NSF will be reflected in the administration's FY '06 budget request.

I think today's hearing will make it clear just how complex the science behind our understanding of tsunami is. I can certainly say that I learned a lot of new vocabulary reading this testimony, as well as discovering that the plural of tsunami is tsunami.

But I want to make sure today that we don't get lost in the complexity and keep a steady eye on our goal, which is saving lives.

The devastating events of December 26 are a wake-up call to all of us that we need to do more to prepare for tsunami. But it can't be the kind of wake-up call that leaves us panicked and disoriented. It cannot be a wake-up call that leads us to race to work only to find later that we're wearing mismatched socks and have forgotten our belts.

We need to take the time now, starting with this hearing and guided by the administration's proposal, to put in place a broad, thoughtful and sustainable program that can save lives here and around the world.

The chair now is pleased to recognize the ranking member from Tennessee, Mr. Gordon.

GORDON:

Good morning.

As usual, I concur with Chairman Boehlert's opening statement. And I want to thank him for calling this important hearing.

As Sheri (ph) pointed out, our caucus did not make appointments until just yesterday evening, so a lot of our new members aren't here. So I'm going to wait to a later time to introduce them.

And I also want to take the opportunity to congratulate our chairman for surviving both a difficult operation and re-election, and we're glad to see you back with us.

And to the new Republican members, I suspect that you all went through pretty difficult elections and partisan. And I hope that you can think of this as a mostly partisan-free zone now and can concentrate on substance and leave the politics back home. So this is what we try to do here.

The tsunami that struck seven nations in the Indian Ocean one month ago shocked the world with their awesome destructive power. We cannot recover the lost lives, but we can

ensure that we are well prepared to deal with the natural disasters here in the United States and that we can help other nations do a better job of preparing, as well.

Tsunamis are rare events, but large ones can have devastating impacts when they occur. Compared to the cost in lives and property, the cost of a tsunami warning and emergency preparation system is very small.

The administration's tsunami warning system improvement plan provides $37.5 million dollars to NOAA and USGS over the next two years to upgrade the Pacific warning system and deploy a detection system in the Atlantic and Caribbean basin.

The plan provides the basis to cover the coastal U.S., and it's a good start.

However, I am concerned that once the headlines have disappeared and the memories of the recent tragedy have dimmed, we may have deployed a network without sufficient funds to sustain its operational capacities.

The current network in the Pacific has six buoys, but three are not operational.

Clearly, maintenance is an issue that we need to consider.

I also believe we need sufficient sustained support for a central public education and state and local emergency preparation, programs that translate detection warning system into life-saving actions.

Most of the funding in the current proposal is devoted to the procurement and deployment of technology.

Mr. Wilson, of the Oregon emergency management, is recommending sustained annual funding of the National Tsunami Hazard Mitigation Program of $7.8 million dollars.

We currently spend $4 million. The administration's proposal includes an additional $5 million over two years. That's $2.6 million less than Mr. Wilson recommends.

So the $37.5 million over two years included in the administration's proposal is a good start but does not appear to be a complete proposal.

And from where does the money come?

If we're spending money to upgrade and expand the tsunami warning system, are we going to pay for it in reductions to other programs, and if so, which ones?

There are other programs at NOAA that are essential to preserve lives and property.

Is tsunami warning system going to come at the expense of nationwide implication of approved flood forecasting models? Will funding for research to improve tornado and hurricane forecasts be cut?

Severe storms and the flooding associated with them occur every year. The forecasting and warning systems for these national disasters also need to be upgraded and maintained.

So as we design and deploy this tsunami warning system, we must provide sustainable funding to ensure its continued operation. But we should not sacrifice other equally important NOAA programs and operations in an effort to develop a temporary response to yesterday's crisis.

If we're going to do this, we should do it right. And doing it right requires that we know the full initial and annual cost needed to deliver the benefits the public expects from this warning system.

We have an excellent witness panel today.

I welcome all of our witnesses to Washington and thank you for appearing before the committee this morning.

And certainly want to welcome our colleague, Jay Inslee, for being here with us. I look forward to your testimony and to hearing your thoughts on how we can best address the development and the end- to-end emergency warning and response system for tsunamis.

Thank you, Mr. Chairman.

BOEHLERT:

Thank you very much.

And it is with mixed emotions that I make this next announcement, but today is the last official hearing for Martha "Marty" Ralston, who is retiring at the end of this week after 26 years of dedicated service to this committee. And she typifies the professionalism and dedication and commitment of the staff of this committee.

And I ask you to join me in saluting her for that service.

(APPLAUSE)

BOEHLERT:

Our first witness on panel one, and our only witness on panel one, is our distinguished colleague, Jay Inslee.

Jay is someone who is, I've learned from long experience, very knowledgeable about the subject matters that he involves himself in, and it's a wide range of activities.

So to my colleague, I say welcome, and we look forward to hearing from you on this very important subject.

INSLEE:

How we doing there? There we go -- high technology at work. We are talking about high technology here.

You know, people describe this event as a biblical event that brought us here today. And the same Creator that created a world that is so dynamic that can create tragedies like this also created the human mind.

INSLEE:

And what we're really talking about at this hearing is the use of the human mind to guard us from these future events, future events that we know are going to happen.

This is not a hearing about something that's uncertain. There is certainty that we're going to experience earthquakes and tsunamis like this. The only question is, when and where?

And you know, Mr. Boehlert, of all the hearings that you've ever had, you perhaps never had one that was so timely. Because 305 years ago today, January 26, 1700, a few miles off the coast of the Pacific in the United States, the Cascadia subduction zone ruptured, and it created an earthquake probably equal or exceeding that off the coast of Indonesia. And it sent tidal waves, tsunamis, perhaps as much as 50 feet high across the Pacific Coast in the state of Washington.

So 305 years ago today, we experienced in the United States an event very similar in scope and potential tragedy as they did in Indonesia.

So you really could not have picked a better day to focus the nation's attention on this issue.

The bad news is we are very exposed. This is a personal issue. My district is connected to the Pacific Ocean on the shores of Puget Sound. Washington has an exposed coastline. But we have many areas in the country that have these potential exposures. That's the bad news.

The good new is, is that we have the scientific capability, due to some extraordinary achievements -- some of, I may note, is from my district -- have the capability of really giving us 100 percent protection in a timely real-time warning of tsunamis.

So that's the good news. And the good news here, there's a success story already -- and the United States is already, before a huge tragedy developed, at least the beginnings of a good system with the six buoys we have in the Pacific now -- already being developed. And that's the success story of some of the advanced thinking of our scientific community of our federal agencies, however, and they should be complimented for that. Now we need to give them the tools to finish that job.

I may note that one of these tools that can detect one inch. These tools that sit on the bottom of the ocean and anchored to the sea floor -- and they use a transducer developed by Peroscientific -- in the 1st District of the state of Washington, I may add, Redmond, Washington. They can note in five-miles-deep water one inch of deviation in the elevation of the water column above them by noticing that pressure distance using incredible technology. We simply need to get it out into the ocean.

And that's why I look forward to introducing this bill with you, Mr. Boehlert, to do that on a bipartisan basis to get this job done.

We're talking about probably 50 buoys worldwide to provide not only America but the world with this protection. And that's one important point, I think, of this effort, is that we need to protect our own coastlines, but we need to use our technological know-how to lead the world in an international system to protect the world's coastlines.

And there's at least preliminary thought about using the Hagemeyer Pacific Tsunami Warning Center in Hawaii as the sort of nerve brain to distribute and analyze this information and distribute the warnings worldwide. And I think that's something we should contemplate because we really are the worldwide leaders.

I want to note just several things that I hope we'll keep in mind as we develop this legislation.

First -- and Mr. Gordon really mentioned it -- is the need for follow-up. This does not simply involve sticking some buoys in the water and calling it a day. And we will be challenged to make sure that this job gets done in several respects, one, the maintenance needs.

And the ocean is fairly unforgiving. Three of our buoys are down now. We need to make sure we have a rigorous maintenance schedule.

And we have to build in redundancy in the system, because some of these buoys are going to be down, no matter what we do, due to the stress of the ocean.

Second -- and this is very important for, I think, the committee to think about -- is that the buoys don't do the job without a warning and educational system for the people on the shorelines. Sending a signal from a satellite to Hawaii and then down from Hawaii to a certain agency of the federal government doesn't do any good if we haven't educated our citizens what to do and how to get the warning to the beaches and to the schools to get that job done.

We started that in the Pacific. I noticed La Push, Washington, is exposed. They've got a bus out there, 24 hours a day practically, to evacuate kids from an elementary school they have there.

So we have a good beginning of that system. But we've got to develop a national system to get that job done.

False alarms -- I also want to talk about a benefit of this that is not often contemplated. One of the problems we have with the existing system is that because it doesn't have sufficient scope, we have false alarms. And when you have false alarms it costs you humongous amounts of money -- if I may use that scientific term.

It cost Hawaii about $40 million when we had a false alarm in the last couple of decades. This, creating a larger system, will eliminate or severely reduce false alarms that will make this system work. It will save us a lot of dollars and loss to human life, shutting down your economy.

Last note I want to make: People have asked about the cost of this. These are very rare events. The last event that damaged United States was 305 years ago. So they're quite rare.

If people have asked you, "Why should we protect against and spend millions of dollars on a rare event?" and the answer is very simple: It's one of the best investments you can make.

You know, we've spent hundreds, literally hundreds of billion dollars on what up to now has been some rare events of the terrorism threat.

We have a threat now that may be rare but equally devastating, and that's tsunamis. And spending somewhere in the order of $40 million to get this job done, there's really no cheaper investment to save Americans' lives, and we ought to make it.

So I want to thank you, Mr. Boehlert.

Mr. Gordon, I look forward to working with you.

And I'll stand ready for your questions or general criticism.

BOEHLERT:

I want to thank you for an excellent statement. I want to compliment you for getting, at last count, seven plugs for your district in.

(LAUGHTER)

BOEHLERT:

You did very well in your representational capacity.

But you underscored the need for a comprehensive approach. It is something more than just appropriating dollars to get new gadgets, and that's very important. There has to be an educational program and it has to be a very comprehensive program. So I thank you for that.

Mr. Gordon, do you have any...

GORDON:

Just concur.

And thanking you. You understand it very well, and you've conveyed that to us and to this group.

INSLEE:
Just one more plug too.
Behind me is Dr. Eddie Bernard. I don't know if he is going to speak today, but he has been an absolute leader in developing this system. And I think we owe our tip-of-the-hats to the scientific personnel who've advanced this technology before an earthquake and a tsunami hit the United States. Those are advanced thinkers.
Thank you, Mr. Chair.

BOEHLERT:
Thank you very much.

WOOLSEY:
Mr. Chairman?

BOEHLERT:
Yes.

WOOLSEY:
Could I ask...
(CROSSTALK)

BOEHLERT:
Ms. Woolsey?

WOOLSEY:
... our esteemed guest a question and make a statement? And maybe you could kind of just, Jay, walk us through this a little bit.
My fear is false security. I mean, you've both said that.
And you just said that, Mr. Chairman.
And you covered it, but you didn't tell us how. I mean, I need to -- I'm sorry I'm a cynic. But I can see this all being put in place and then an event occurs and we go, "ah," we hadn't -- didn't prepare...

BOEHLERT:
Ms. Woolsey, let me point out that not all the wisdom is vested in the distinguished representative of the 1st District of Washington.
(LAUGHTER)

WOOLSEY:
Yes, but he's got a wonderful mind and...
(CROSSTALK)

BOEHLERT:
He does, indeed, but we have some of the foremost experts, not just in America, but in the world who are going to testify today.

WOOLSEY:
Behind him?

BOEHLERT:
Yes, and...

WOOLSEY:
So that's my "I have to wait and hear from them"?

BOEHLERT:
No.
Jay, you can add anything you might care to add right now. But...

WOOLSEY:
Thank you.

INSLEE:
I think the chairman is calling for a little humility from the witness, so perhaps I should just display that.
No, I just think in the serious question about -- this panel needs to find a way legislatively to build a foundation for funding for the ongoing maintenance and educational needs.
And, I think again, it may be easy, quote me, "a little bit of a no-brainer" to put the buoys in. And we are going to have to figure out a way, with the concurrence of other committees, to build in the appropriations and the infrastructure to get particularly the educational and the warning systems domestically that are needed, including the Caribbean and even East Coast, where they really don't exist.
We've got a rudimentary system in Washington state. We really don't on the Caribbean, pretty much, at all.
So I guess what I would say is, I'm looking to your great ideas, Lynn.

WOOLSEY:
OK, thank you.

BOEHLERT:
Well, thank you very much and we would welcome...

GORDON:
Mr. Chairman?

BOEHLERT:
... your continuing input as we go forward with the development of legislation.
Because make no mistake about it, this is not just a hearing; this is the beginning of a journey, and we're going to travel it together, and we're going to develop a

comprehensive legislative initiative that we hope will be marketable to our colleagues in the nation.

Bart?

GORDON:

Yes.

I don't know whether Jay wants to respond to this or maybe the panel of experts can work it into their statement, but I'd like to know if we've done enough to create mathematical models that could be used on an emergency basis to know an earthquake occurred here, therefore we have to evacuate this area or we might have to evacuate that area, and also whether we have an early warning system and evacuation system that's integrated, whether it is tsunami or whether it is some other disaster or whether it is a dirty bomb.

That is to say, when we're planning for evacuation and warning, it ought to be comprehensive system.

Perhaps either this witness or the next can focus on that.

BOEHLERT:

Sure, yes.

Because as you will learn -- as the testimony goes forward -- I've had the opportunity to look at the testimony -- this very important point is being addressed.

INSLEE:

Very quick comment: I'm very convinced that with all our tremendous ability to evaluate the seismic wave that we can pick up on our seismographers, that is not even close to good enough to really give us predictability of where a wave is going to hit and what its extent is. I think the scientist will back me up on that, I hope.

We really need the buoy system to find out if the wave is there. Otherwise, you're stuck with continual false alarms. You'd have lack of compliance with that issue, you have enormous economic cost. You really need to use this science to find out if the wave really exist.

And I look forward to bipartisan success doing that.

BOEHLERT:

Mr. Gilchrest?

GILCHREST:

Thank you, Mr. Chairman.

Just a quick statement here, because I may have to leave shortly for another hearing.

I recently visited, Jay, the Indian Ocean basin where all the countries were hit. The destruction was staggering, incomprehensible.

The response to that by the international community was stunning, and it continues to be that way.

When we went to Banda Aceh, or Phuket, or Sri Lanka, or India, we asked a number of questions of people whose lives were torn apart.

The most curious question and their most curious response was, "How did this happen?" and, "What can we do to prevent it?"

We asked them did they know how this happened, and they didn't. And whether it was the Buddhists, whether it was the Muslims, whether it was the Hindus, they were all curious not as to why it happened -- they didn't want to associate that with any religious aspect -- they wanted to know how it happened, the physics behind the tsunami, and then they wanted to know how they could find out if it was going to happen again.

So we have worldwide interest in this issue. It revealed the common humanity of all people: religion was set aside, national origin was set aside, race was set aside -- the idea that humans can get together in this most dynamic process of nature and how a tsunami works.

So, Mr. Chairman, and to the ranking member, we have huge momentum behind this issue not only for the United States and all our coastal areas, but the U.S. can be a leader in the world to protect these vulnerable shorelines.

INSLEE:

What you said about when you asked, "How did this happen?" it sort of pointed out to me the need for education, how important it is for this from a safety standpoint.

I think in '64 was the Alaska earthquake. I was living in Seattle at the time, so I saw -- and one of my classmates explained how they watched the water recede. All the water went out of the harbor before the tsunami came back in. And we all knew in Seattle, in that classroom, that if you ever see Puget Sound go out, you head for the hills.

In Phuket and other places in Thailand, the tourists headed to the beaches to watch this abnormal occurrence, which is, you know, a terrible tragedy.

This points out the need for an educational effort that I know the chair is going to lead us to build.

BOEHLERT:

Thank you very much. Thank you, Mr. Gilchrest, thank you.

Our second panel today consists of Dr. Charles "Chip" Groat, who is director of the U.S. Geological Survey; General David L. Johnson, retired, director of the National Oceanic and Atmospheric Administration's National Weather Service; Dr. John Orcutt, deputy director, research at the Scripps Institution of Oceanography and president of the American Geophysical Union; Dr. Arthur Lerner-Lam, director, Columbia University Center for Hazards and Risk Research.

And for the purpose of an introduction, the chair recognizes Mr. Wu.

WU: Thank you, Mr. Chairman.

It is my honor to introduce Mr. Jay Wilson of the Oregon Emergency Management Office.

But first I would like to thank the chairman and the ranking member on holding this very timely hearing.

The December 26th tragedy in the Indian Ocean earthquake and the following tsunami was a tremendous tragedy, and we should do all that we can to help in the present situation.

And I want to commend people and organizations around this country, but particularly some organizations, non-profits and businesses in Oregon, who have generously helped

Northwest Medical Teams, Medical Teams Northwest, some for-profit businesses like Nike and Intel.

It is my understanding that the employees at Intel alone have contributed a million dollars and matched $5 million from the Intel Foundation.

And I want to thank all Americans for their generous contributions.

WU: And while we deal with the current situation in Indonesia, Sri Lanka, Thailand and elsewhere, at the same time we should be very cognizant of the possibility of significant tsunamis occurring in the United States.

And as Mr. Inslee previously stated, perhaps the greatest, largest tsunami to ever hit our shores occurred 305 years ago today, January 26, 1700, in Oregon and Washington, where two tectonic plates come together.

And it is -- the way that we calculated this date is that there are historical recordings in Japan, thousands of miles away, at a certain date and hour when that tsunami hit the shores of Japan back in the 1700s.

And the geologists and geophysicists tell us that these huge subduction earthquakes can occur on our Pacific Northwest coast every 300 to 1,000 years. That is the current estimate.

I note that we are 305 years away from the last occurrence. So we are in the yellow zone, if not the red zone, for another significant event in the Pacific Northwest.

Much more recently, there was a 9.2 Richter scale earthquake off of Alaska, and it created 19- to 20-foot waves, which flooded seaside Oregon in March of 1964.

With the Pacific Rim's experiences in earthquakes and tsunamis, we on the West Coast take this threat very, very seriously.

Several Oregon research universities, such as Portland State University, Oregon State University and the University of Oregon, conduct cutting-edge research in tsunami, and I'm also very pleased to say that along with other Pacific Coast states work together to prepare and educate our citizens on the threats of tsunami.

And I would especially like to mention Cannon Beach, Oregon, in my district, as well as Manzanita and Nehalem, on the border of my colleagues' and my district, for being some of the four Oregon communities which are rated as TsunamiReady communities.

It is my pleasure to introduce Mr. Jay Wilson to this distinguished committee.

Mr. Wilson is currently the earthquake and tsunami programs coordinator for the Oregon Emergency Management Office. He has been working in the emergency management field in California and Oregon and now works hard to prepare Oregonians for tsunami.

I'm very happy to hear that Mr. Wilson's latest work is of a creation of a tsunami educational pilot project in Seaside, Oregon.

And at this moment I would like to yield to my colleague from Oregon, Ms. Darlene Hooley.

HOOLEY:

Thank you.

Again, welcome Mr. Wilson.

I had the privilege of spending time with some of the people that you work with as they did briefly inform me in Salem, all of the statewide experts in this area.

So I appreciate what Oregon is doing.

And it was interesting as I was -- a flight a couple of weeks ago, I was sitting next to a gentleman who does a lot of work in this area. He does it both nationally and internationally. And he leaned over and he said, "Oregon has done the best job of preparing of any state."

So I think we should feel good about that.

We also had a series of hearings on the Central Coast to see what they were doing and how prepared they were.

I was pleased by the work that we've done. There's a lot more work that needs to be done.

But at each of these hearings we had all of the emergency management people. We had first responders, as well as elected officials and community members, talking about what each of those two counties have done, which are the Central Coast, Lincoln and Tillamook counties.

And one of things I'd like to do, Mr. Chair and Mr. Ranking Member, is when we talked, these groups came up with several really fabulous ideas. I asked them to go back and meet again and put those in ranking order.

And what I would like to do, Mr. Chair, is introduce those to the committee so that we may use...

BOEHLERT:

Thank you very much. The committee would be most receptive.

HOOLEY:

And again, thank you.

BOEHLERT:

Thank you, everyone.

Now let's get to our distinguished witnesses.

And we would ask that you summarize your statements in five minutes or so. The chair will not be arbitrary. It's too important a subject.

But if you condense your testimony, because we have your full written testimony, which will be part of the official record, that will allow more time for those of us who need to be better educated to take part in this exercise.

So with that, Dr. Groat, you're first up.

GROAT:

Thank you, Mr. Chairman.

Thank you for the opportunity to reflect on the recent tragedy in South Asia and important to us here in the United States, what can be done to reduce the threat that tsunamis and earthquakes pose to coastal communities in the United States, as well as around the globe.

Events such as this one -- and we are also reminded by the four hurricanes that crossed Florida this past summer, recent volcanic activity at Mount St. Helens -- point out our vulnerability to natural hazards.

And those natural hazards, such as all of these, are inevitable. They're geological and meteorological inevitable. But as has been pointed out several times, the consequences are not inevitable if we prepare for them.

As we move forward, we've go to bear in mind that we are being confronted here with multiple hazards. Both the tsunami, the earthquake have to be considered in planning our responses and instructing our scientific understanding as we move that forward in the name of public safety.

On December 26, 2004, a magnitude 9 earthquake that struck the coast of Sumatra was initiated 20 miles beneath the sea floor off the western coast. And it was the fourth largest earthquake to strike the planet since 1900 and the largest since the magnitude 9.2 earthquake struck Alaska in 1964.

The devastation caused by both the tsunami and the earthquake are of grand proportions and remind us, again, of the effects of these natural events on lives and property.

As other giant earthquakes, this one took place in a subduction zone, where one of the tectonic plates that make up the earth's rigid outer layer is being thrust against another.

The size of the earthquake is directly related to the area of the fault that is actually ruptured.

This particular rupture was huge. It propagated northward along the plate boundary for almost 750 miles.

Along the length of the fault rupture, the sea floor was jolted upward as much as 15 feet, lifting trillions of gallons of seawater, a volume more than 30 times that of the Great Salt Lake, and generating a tsunami that swept both east, inundating the coast of Sumatra, Thailand and Burma, and west, crossing the open ocean at hundreds of miles an hour on its way to the coasts of India, Sri Lanka and eventually eastern Africa.

The devastation that struck the coastal Sumatra area can be seen on this pair of Landsat images from before and after the event.

While not all tsunamis are caused by earthquakes, most are. Thus, earthquake-monitoring networks play a large roll in tsunami warning center operations.

It's necessary to determine, based on the interpretation of seismic waves generated by an earthquake, whether a tsunami generation is likely or not.

This is an extremely important fact because there are many kinds of earthquakes, and not all that are large even generate tsunami.

So interruption of the information we get from this monitoring network is critical in informing those responsible for tsunami warnings whether or not there's likely to be one.

To monitor seismic events worldwide, the Global Seismographic Network, the GSN, maintains a constellation of 128 globally distributed modern seismic sensors.

U.S. Geological Survey operates about two-thirds of this network, and the University of California-San Diego, operates the other third with NSF support.

NSF also funds the IRIS Consortium to handle data management and the long-term archiving.

As you pointed out, Mr. Chairman, the role of NSF and funding both the monitoring and the science in this important area is extremely important and needs to be continued and increased.

In the case of the Sumatra earthquake, automated analysis of data from the Global Seismic Network stations generated the alerts of strong recorded amplitudes that were sent to NOAA and the USGS.

At the present time, about 80 percent of this network transmits data in real time that can be used for rapid earthquake analysis and tsunami warnings.

A hallmark of our efforts to upgrade this system is to increase our ability to receive this data in real time and upgrade our capability in the scientific community of analyzing this data very quickly and providing the results of those analyses to people responsible for issuing warnings.

In the United States, we face a major risk from subduction zone earthquakes like the one that struck Sumatra.

The most recent was a magnitude 9.2 earthquake that struck Alaska in 1964, although the greatest risk, as pointed out by several members, is in the Pacific Northwest.

At the 1700 Cascadia subduction zone that was mentioned before, earthquake along Pacific Coast in Oregon, Washington, California and British Columbia is particularly notable. This event was of the same general size as the Sumatra earthquake, and it caused coastal marshes to suddenly drop several feet.

Based on return interval, USGS scientists and others who work on this aspect of it have estimated that there is a 10 percent to 14 percent chance of a repeat of the Cascadia magnitude 9 earthquake and tsunami event in the next 50 years.

So that gives you some sense of the order of risk that we're facing, as Mr. Wu pointed out.

To monitor earthquakes in the United States, the USGS has begun to install and operate the Advanced National Seismic System, part of the NEHRP process, to provide seismic data to NOAA's tsunami warning centers.

The system includes a 63-station ANSS backbone network, which is capable of locating most felt earthquakes nationwide, and provides data in near real-time to the USGS.

Extending our capability in high hazard areas of the U.S. are 17 regional seismic networks that provide detail coverage and rapid response. And local expertise in event analysis and interpretation of this data is an important part of these local networks.

On December 29th, the president asked the departments of Commerce and Interior to determine whether our warning systems are adequately prepared for tsunamis that could affect the United States coast and the coast of those interests that the United States has.

As a result, the administration has announced its commitment to implement an improved domestic seismic detection and warning system.

And as part of the president's plan, the USGS will upgrade its ability to provide NOAA with timely interpretation of seismic data from earthquakes, including their potential for tsunami generation by doing the following.

And I want to point out here that the point that we can start and then forget is not lost on what we propose to do.

We are trying to upgrade a system that's important not only to tsunamis, but also to earthquakes, and provide the resources that will continue this system in an advanced state of readiness in the outcoming years so that we do not become complacent and figure we solved the problem with a one-time effect.

So we plan to implement 24-by-7 operations in the National Earthquake Information Center in Golden, Colorado, and upgrade the hardware and software systems in order to improve the processing of earthquake data from the U.S. and around the world.

As part of this upgrade, we'll fully develop what is now a prototype system to estimate the number of people affected by strong ground motion after an earthquake using our ShapeMap model and databases of global population.

This PAGER system, which stands for the Prompt Assessment of Global Earthquake for Response, can provide aid agencies and others with a quick estimate of how significant casualties might be well in advance of reports from effected areas where communications by be down. So here, again, an important forecasting tool to provide those responsible for response with early information.

Thus, these improvements that the NEIC, the National Earthquake Information Center, will increase our ability to provide relevant information about earthquake hazards, as well as their tsunami generation potential.

We also plan to support research to develop more rapid methods for characterizing earthquakes and discriminating likely tsunamigenic sources -- here again, the importance of determining which earthquakes do and will generate tsunamis.

We also plan to improve the detection response time of the Global Seismographic Network by making data from all stations available in real-time using satellite telemetry and improving station up-time through increased maintenance schedules.

This, again, has been pointed out as an extremely important part of any warning system. We have to have the resources to make sure that it is upgraded, that it is maintained so that it is always ready.

We also intend to improve coverage in the Caribbean region. We'll achieve that through the addition of some seismic stations there and upgrades of existing stations through cooperation with international partnerships in that area.

And finally, we will further the use of software developed by the California Integrated Seismic Network, which is an USGS university and state partnership, to spread USGS-generated earthquake information directly to local emergency managers with a dual-use capability to also provide that information to NOAA.

And finally, finally, getting to the importance that has been pointed out of understanding what the impacts on our coastal areas will be -- do we understand the nature of the topography, the terrain, the infrastructure that's there in a way that can be fed into models for the generation of projected impacts?

We plan, as part of our cooperative effort with NOAA and others, to enhance our capabilities to provide elevation mapping for coastal areas in the United States and in the Caribbean and provide this information for improved tsunami hazard assessment in the U.S. in general, but particularly in Puerto Rico and the Virgin Islands.

The Sumatra earthquake, which contributed significantly to the loss of lives and property, will encourage us to continue forward on the comprehensive NEHRP approach to earthquake loss.

Here, again, I think a model of interagency cooperation where we, FEMA, NIST and the National Science Foundation work together to translate good science into hazard reduction program so we translate our understanding through monitoring and research through such initiatives as the Advanced National Seismic System, but also in the work of the George Brown Junior Network for Earthquake Engineering Simulation.

These activities will accelerate the use of new earthquake risk mitigation technologies and the development of improved seismic provisions in building codes.

In closing, Mr. Chairman, the USGS will also continue ongoing collaboration with NOAA, FEMA and other agencies and universities to improve tsunami hazard assessment and warning through geologic investigations into the history and the potential for tsunami occurrences.

We learn about the present from understanding the past and the records of things that happened pre-history are extremely important.

GROAT:

So geologic and geomorphic understandings are gained through active research and active mapping, and we plan to continue that.

We also plan to help provide better products in terms of inundation maps and propagation maps and supply information that will support the very kinds of models that were questioned before.

And then we will also continue in the Indian Ocean to understand, based on that, what the impacts were there to inform our understanding in United States.

With that, Mr. Chairman, I'll close and be welcome to questions.

BOEHLERT:

Thank you very much.

It was that third "finally" that got me.

GROAT:

Sorry. Yes, I got one "finally" ahead of myself, I'm sorry.

BOEHLERT:

It is very important and, you know, we deal with some of the most sensitive issues of our time. And when we ask people to summarize in 300 seconds or less, I always feel that we sort of cheat ourselves. But we have to be mindful of everybody's schedule and everything else.

So thank you very much, Dr. Groat.

General Johnson?

JOHNSON:

Thank you, Chairman Boehlert and Mr. Gordon and members of the committee, for the opportunity to testify before you regarding the National Oceanic and Atmospheric Administration, NOAA, activities with regard to the tsunamis.

I'm Brigadier General David L. Johnson, the assistant administrator for weather services and the director of NOAA's National Weather Service.

And I ask that my written testimony to be submitted for the record.

As my time here today is limited, I will focus my oral testimony on describing the U.S. tsunami program, NOAA's response to the Indian Ocean's tsunami, NOAA's role in the administration's tsunami warning proposal, and how the United States can help the world prepare for tsunamis.

The U.S. tsunami warning system consists of two warning centers: the Richard H. Hagemeyer Pacific Tsunami Warning Center in Ewa Beach, Hawaii, and the West Coast/Alaska Tsunami Warning Center in Palmer, Alaska.

The Hagemeyer warning center in Hawaii was established in 1949 in response to the unpredicted 1946 Aleutian tsunami, which killed 165 of our citizens on the Hawaiian Islands.

The 1967 Alaska warning center was created as a result of 120 deaths from the 1964 great Alaska earthquake and tsunami that's already been mentioned here today.

These centers are responsible for issuing all tsunami warning, watch, advisory and information messages to emergency manager officials and to the public.

Now, NOAA operates six deep-ocean assessment and reporting of tsunami, or DART, buoys to help issue these accurate warnings.

NOAA research activities developed these buoys to measure tsunamis in the deep ocean and to transmit the information back to the warning centers.

These instruments accurately calculate the size of the tsunami by measuring the pressure wave from the deep ocean floor as it passes. And tsunamis as small as a half a centimeter have been measured.

In November of 2003, the DART buoys demonstrated their effectiveness when a large earthquake occurred in the Aleutian Islands and generated a tsunami.

The two warning centers evaluated the tsunami and confirmed only a small wave. This accurate prediction of the non-destructive tsunami saved Hawaii an estimated $68 million in projected evacuation costs.

The Hagemeyer warning center also serves as the operational center for the International Tsunami Warning System of the Pacific, which is comprised of 26 member-nations around the Pacific Rim.

The Hagemeyer center's primary responsibility is to issue tsunami warnings in the Pacific Basin for tsunamis that can cause damage far away from their source.

It is not the center's responsibility to issue local tsunami warnings from seismic events.

For example, if an earthquake occurs off the coast of Japan and a local tsunami is generated, it is Japan's responsibility to issue the local tsunami warning.

However, the Hagemeyer center will warn all participating nations in the Pacific Basin if the Japanese tsunami will cause damage.

NOAA's tsunami warning centers have no authority or responsibility to issue tsunami warnings for the Indian Ocean Basin. However, knowing the concerns specific countries have about potential damage, on Sunday the 26th of December 2004 at 8:14 p.m. Eastern Standard Time and within 17 minutes of notification and 15 minutes of the Indonesian earthquake, both centers issued tsunami information bulletins.

Now, sea level gauges are also essential elements of the current tsunami warning system in the Pacific.

When strategically located, they can also be used to quickly confirm the existence, or non-existence, of tsunami waves following an earthquake, to monitor the tsunami's progress and to help estimate the severity of the hazard.

Unfortunately, there was no sea level data or other information available to substantiate or evaluate the Indian Ocean tsunami until hours after the earthquake had happened and when the first news reports began to come in indicating casualties in Sri Lanka and Thailand.

As recently announced by my boss, Admiral Lautenbacher, undersecretary of commerce for oceans and atmosphere, the United States is now committed to complete the current tsunami warning system for the United States by 2007.

NOAA's contribution to the plan includes procuring and installing 32 new DART buoys, including 25 in the Pacific and seven in the Atlantic and Caribbean.

In addition to the DART buoys, NOAA will procure and install 38 new sea level monitoring and tide gauges.

And the administration has proposed $24 million to NOAA for this effort, including $18.1 million for the Pacific Basin and $5.9 million for the Atlantic-Caribbean Gulf.

With that expansion of the U.S. tsunami warning system, NOAA forecasters will be better able to protect the United States 24/7, and will be able to alert communities within minutes of a tsunami- producing event.

I agree, education and outreach are key to ensure people take appropriate action when the warnings are issued. NOAA's Tsunami Ready program prepares community to learn from the events of just one month ago and to ensure we educate the public about potential impacts of tsunamis and to ensure every vulnerable coast community is tsunami- ready certified.

I solicit your help to make this happen.

We are prepared to export this important program to whomever needs it now.

With global attention on this matter, we have a great opportunity to help the world better prepare for tsunamis due to the development of a Global Earth Observation System of Systems, or GEOSS.

This system would include real-time seismic monitoring network, a real-time DART network and a real-time sea level monitoring network.

NOAA's administrator, Vice Admiral Conrad C. Lautenbacher, will be a member of the U.S. delegation at the third Earth Observation Summit taking place in Brussels this February.

He will ensure the development of a global tsunami warning system is a high priority for the larger Earth-observing system of systems.

We look forward to working with the Congress and other nations around the world to help take the pulse of the planet and to make our world a safer place.

And I, too, am happy to take your questions at the end.

Thank you, Sir.

BOEHLERT:

Thank you very much, General.

Dr. Orcutt?

ORCUTT:

Mr. Chairman and members of the committee, thank you very much for inviting me.

I am John Orcutt, deputy director of Scripps Institution of Oceanography and president of the American Geophysical Union, the AGU.

On the 26th of December last year, a 1,200-kilometer length of the sea floor ruptured during the Sumatra earthquake. The rupture took at least six minutes to propagate breaking rock the entire way.

The earthquake generated a devastating tsunami, but there was no systematic warning distributed to coastal populations.

The energy in the event exceeded 500 megatons of explosives.

Adding to the tragedy is our knowledge that so many of the deaths could have been prevented if tsunami detection technologies had been more extensively employed and at-risk populations had been educated about how to react.

The power of education is clear. A colleague of mine, Chris Chapman, a British seismologist on holiday in Sri Lanka, understood the drastic rapid retreat of the ocean from the beach signaled the arrival of a tsunami.

He convinced his hotel manager to get on the beach with a bull horn and warn people, direct them to retreat inland or to higher stories of the hotel. Many lives were saved by Chris's perception and persistence.

In a similar story involving, again, a Briton, a 10-year-old British girl, Tilly Smith, was visiting Thailand with her parents. Two weeks earlier she had done a school project on tsunami and earthquakes. And with this information alone, she was able to warn and save more than 100 lives.

Long time-intervals between tsunamis, tens of hundreds of years, poses a great challenge to sustain education efforts for the entire coastal populations.

In addition to education, of course, expansion of the Global Seismic Network, the GSN, is critical to detect tsunamis triggered by earthquakes. With more seismic stations, we can more readily determine the true size of the event, whether the event is deep and not tsunamigenic, or shallow and likely to cause a tsunami.

With a comprehensive network of seismic stations, the important surface waves from an earthquake will begin to arrive about seven minutes after the rupture begins. And information from all parts of the fault surface will be available after about 13 minutes.

Once the information from the fault service has arrived, it's possible to compute this earthquake source mechanism in about a minute.

Taking another minute, the source mechanism can be propagated to determine the tsunami's path. This scenario that I've explained of 15 minutes is really very optimistic, because a tsunami can travel at nearly 500 miles an hour.

The real Sumatra tsunami would have traveled 125 nautical miles, nearly halfway from its initial break to Sumatra.

In many parts of the world, proximity to the origin of the tsunami makes warnings almost impossible. In these cases, an informed population is essential.

But a Caribbean-enhancing GSN coverage is particularly important. The Caribbean, Hispaniola and Puerto Rico trenches are sites of past tsunamigenic earthquakes, and tsunamis will occur there in the future.

To avoid false warnings, false alarms, tsunami model information must be verified using tide gauges and pressure gauges.

If several of these had been installed, for example, on the West Coast of Sumatra and telemetered to a warning center, the tsunami could have been verified well before it reached Sri Lanka, India, Diego Garcia, the Maldives and Africa.

I've mentioned some of the available technologies might be deployed. Unfortunately sustaining tsunami-warning infrastructure over many years will be a tremendous challenge.

Even in the Pacific, tsunamis do not occur often. Between major tsunamis, the NOAA centers have always had a hard time maintaining their budgets and personnel.

The El Nino monitoring array has funding problems even though El Nino occurs every three to seven years and everybody on the planet knows its effects.

The administration's proposed tsunami warning system would deploy many single-purpose buoys.

I'm extremely concerned about the ability to maintain such a system. I believe a more sustainable approach would be to deploy additional shore-based pressure gauges and integrate the proposed NOAA system with the National Science Foundation's Ocean Observatory Initiative plans to include bottom-pressure gauges on mid-ocean buoys that serve a wide variety of disciplines.

The OOI also includes plans for sea floor seismic observatories greatly enhancing the densification of seismic stations I discussed earlier.

And off the coast of Washington and Oregon, a planned cable observatory will include seismic stations and bottom-pressure gauges to form a dense tsunami observatory network.

The OOI is expected in the president's FY '06 request for the NSF.

The administration's plan recommends 24/7/365 operation of the National Earthquake Information Center satellite telemetry to the entire GSN and increasing station coverage.

I strongly support these recommendations.

Furthermore, to have the greatest efficacy, data should be openly available.

Unfortunately, today current operations and maintenance funding of $5 million a year -- $2 million from the NSF, and $3 million from the Geological Survey -- for the GSN is not adequate.

As a result, GSN is deteriorating and requires an additional $5 million a year, based on several studies in IRIS and in USGS.

Because the tsunami warning system will need to be maintained in perpetuity, we must develop strategic knowledge about high-risk tsunami areas to lower long-term cost.

In order to accomplish this, NOAA and the Geological Survey tsunami hazard mapping effort should be expanded, and detailed asymmetry survey should be undertaken to identify important slumps for monitoring.

We must also explore the development of cheap monitoring technology, exploiting the Global Positioning System, or GPS, using ocean buoys and ships is an interesting alternative to pressure gauges to verify tsunami.

Horizontal tsunami motion would be detectable from a buoy or even a ship underway, and cost may be lower using that technology.

As president of the AGU, I was asked by the U.N. Environmental Program to write a brief report proposing an Indian Ocean tsunami warning system.

This report is not complete, though it will include a number of approaches, including increasing the number of GSN stations; developing a tsunami warning center or centers for the region; improving telemetry to the stations and between the center and the many states in the Indian Ocean; exploiting modern and grid-based cyberinfrastructure; installing a large number of telemeter pressure gauges; and installing communications needed to distribute a tsunami warning to the public.

The location and magnitude of the 26th of December Sumatra earthquake was determined in time from mitigating measures to be taken in Sri Lanka, India, the Maldives and Africa to prevent extensive loss of life.

The lack of civil infrastructure to warn people was, unfortunately, the weak link in the system.

Thank you again, Mr. Chairman, and members of the committee.

I'm happy to answer any questions.

BOEHLERT:

Thank you very much.

Dr. Lerner-Lam?

LERNER-LAM:

Thank you, Mr. Chairman, Mr. Gordon, members of the committee, thank you very much for the opportunity to provide testimony on such an important matter facing us today.

This committee, of course, has been long supporter -- long been a supporter of basic science and research in United States. And this support has enabled many of us to participate in discussions of the tsunami warning system, to talk about the role that basic science has in developing such systems, and to talk about the role that basic science plays in protecting the population and our societies.

My comments today -- I am a seismologist at the Lamont-Doherty Earth Observatory. I'm also the director of the Center for Hazards and Risk Research.

As a seismologist, I share many of the comments that Dr. Orcutt made, as a director of a center that is concerned with the use of this information to protect populations.

My comments today will be oriented toward how we should perceive the risk of tsunamis in the presence of other natural-hazards risks.

My first slide shows this tsunami to be an extreme event.

The number of deaths as of last Thursday in the South Asian tsunami is well over 200,000. But you can see that persistent tsunamis, particularly in the Pacific and in some cases the Indian Ocean, also killed tens of thousands of people.

In some sense, these are extreme events in that they have an extreme impact outside of our experience.

In another sense, some of the generative events, some of the events that caused these tsunamis, can be forecast in ways that pertain to our understanding of basic science.

We've attempted to do this with a basket of natural disasters, including droughts, earthquakes, landslides, floods, severe storms and other disasters and earthquakes.

The point of a map like this is to show that the world is indeed a dangerous place, that there are areas in the world that have persistent hydrometerological and geophysical impacts from disasters, and that the United States, on a global basis, luckily suffers a relatively low mortality.

But in terms of economic risks, the United States has a severe exposure. And, again, these exposures to a basket of hazards are significant.

I would point out in a slide of this sort that the hydrometerological disasters -- such as the floods and the storms as well as the geophysical disasters, the landslides and the

earthquakes -- are decent proxies for what might be expected if a severe tsunami impacted the United States.

Now, in some sense a calculation of this sort is an annualized calculation. This is what we expect from the normal physics of the earth.

On the other hand, we're faced with the events of December 26th, which is in reality extreme. These are extreme events to which we really do not have good statistics. We simply don't have a long enough instrumental record.

In this case, how do we approach the risk?

I think there are two approaches: We need to persist in our understanding of the events that happen all the time and to develop systems that allow us to mitigate the impacts of those events both for the nation and globally, but we must also take a precautionary approach toward these extreme events, especially when, like the current tsunami warning system, the cost of setting a system are low relative to the enormous impacts that might occur.

Elements of a tsunami warning system that should be considered by this committee have been touched on by some of the other testimony, but I will reiterate some of these points.

First, rapid estimation of the size of large tsunami-generating events is an important component.

An interesting point about this is that this must be integrated with basic research, for it is research by the National Science Foundation and by the external grants program of the U.S. Geological Survey that provides us with the basic knowledge that allows us to characterize these enormous extreme events.

It's something that the operational entities need to take advantage of.

Secondly, as has already been stated, we need to maintain the very broadband nature of these global seismic networks, because it is only the broadband nature that allows us to look particularly at these very great earthquakes.

We have some specific concerns, which are detailed in my written testimony.

We've already touched on the notation of redundancy, and I will simply state that the redundancy is a factor not only of the geographic coverage in both the seismometry and in the buoy systems, but in the engineering, research and development that must occur for basic elements of these instruments.

In my view, the administration's proposal is lacking in engineering R&D funds.

A second set of elements to consider is the need to ensure sufficient local capacity to use these warnings. We're about to hear some details on that, but I would also point out that this is of significant importance internationally.

As we already know, the warnings cannot be used unless there is infrastructure on the ground, capacity on the ground to use them. And this is a particular problem if the United States is to take a leadership role internationally.

Data archives for performance-based assessments of these systems need to be implemented so that we understand, as in cases in December 26th, what might have gone wrong, what needs to be improved and what other research and technology we need to implement to provide adequate warnings.

And finally, stable support for operations and maintenance, as well as engineering research and development needs to be found.

Finally, the leveraging of the tsunami warning systems ought to be done in two ways.

The tsunami warning system ought to be a step toward the system of systems, as we know, GEOSS. What we need to do is to ensure interoperability among the international partners and among the different observing systems. And, in fact, the tsunami warning system, as proposed, can be a confidence-building measure in that way.

We also need to ensure that the dual goals of both the research and the operational communities are satisfied and, again, that tsunami warning system provides that confidence-building measure as a pilot program.

My final remark, that the U.S. ought to show leadership in linking global earth observations to smart recovery in the Indian Ocean and the sound development elsewhere in the world because, after all, hazards are problems of the poor not just of the developed world.

Thank you.

BOEHLERT:

Thank you very much.

Mr. Wilson?

WILSON:

Good morning, Mr. Chairman and members of this committee.

I'm honored by the opportunity to represent the state of Oregon's tsunami programs.

I would also like to acknowledge our state partners, Washington, Alaska, Hawaii and California, which participate in the National Tsunami Hazard Mitigation Program.

As the earthquake and tsunami program coordinator for Oregon Emergency Management -- oh, I should say next slide -- I represent this office and state of Oregon on several statewide, regional and national earthquake and tsunami councils and commissions.

Much of my time is spent conducting education, technical assistance and program support to local officials and collaborating with state and federal counterparts on related projects and policies.

One of the greatest challenges for the state of Oregon is creating and sustaining a culture of awareness in the populations of coastal residents and coastal visitors so they know instinctively that strong ground-shaking at the coast is their signal to evacuate immediately to higher ground.

In fact, the most lives saved in the Indian Ocean were due to the educated response of a few people who recognized the signs of an oncoming tsunami.

In the case of the U.S. coastlines, the most cost effective means of solving this problem is the long-term support of the state tsunami hazard mapping and mitigation programs.

We recommend that the National Tsunami Hazard Mitigation Program be permanently funded at the level of at least $7.8 million per year in NOAA's base budget and that $390,000 per year of this support could be allocated permanently to each of the five participating member- states, a total of about $2 million per year.

This is to support long-term tsunami hazard mapping, intensive education programs and the strengthening of local emergency notification infrastructure.

Next slide.

NOAA's National Tsunami Hazard Mitigation Program has been instrumental in increasing the capacity of the five member-states to conduct tsunami run-up modeling and mapping and to tailor tsunami education and outreach to local communities.

Without this federally funded program and its portion for each state, there would be little, if any, tsunami programs in our states.

The National Weather Service's TsunamiReady program is an excellent incentive for communities to reach at least a minimum standard of readiness.

Reasons for so few participating communities in TsunamiReady could be that this is a relatively new program, but more importantly programs certification requires a large investment of time and resources from the local communities.

These investments include installing and maintaining an emergency notification infrastructure, posting tsunami signs, evacuation planning, and conducting drills and educational activities. And many coastal communities have limited resources to carry out these program requirements.

Since meeting the program criteria is a local responsibility, TsunamiReady participation should be encouraged by the permanent increased allocation for the annual tsunami budgets for the five states.

Next slide.

In 1995, Oregon created legislation that calls for mapping tsunami inundation zones, and this includes limitations on new construction and requires tsunami drills in K-through-12 schools within the inundation zones.

Tsunami inundation maps are prepared in Oregon by the Oregon Department of Geology and Mineral Industries in collaboration with NOAA and with local partners in academia, principally the Oregon Graduate Institute of Science and Technology.

Based on numerical models of site-specific tsunami behavior, the inundation maps are indispensable. Without them, evacuation planning for complex areas, such as estuaries and bays, are mere guesswork.

Inundation maps are supported mainly by NOAA funds to the National Tsunami Hazard Mitigation Program, with support by the state principally with labor in-kind contributions.

Without the federal funds, there is virtually no likelihood that these specialized mapping projects would have been realized.

Next slide.

The National Tsunami Hazard Mitigation Program has also funded the creation and printing of local evacuation maps, produced from the inundation maps. These maps are then distributed as free brochures by local government.

Depending on the resources available to local communities, some jurisdictions continue printing the brochures, while others, particularly rural unincorporated communities, often need continual financial aid.

Last slide -- No, sorry.

(UNKNOWN)

(inaudible)

WILSON:

Yes, thank you.

(LAUGHTER)

The administration's proposed detection and warning system is essential for issuance of worldwide warnings about large, distant trans-oceanic tsunami.

It is important to note that the current buoy network and the administration's ocean-wide buoy program would do little to limit loss of life in coastal areas that are right next to tsunami-generating earthquake faults.

Travel time from the Cascadia earthquake source to the U.S. West Coast is too short for the proposed system to operate effectively. In fact, the existing buoys are designed and located to detect and measure outgoing tsunami.

Oregon's communities at the coastline have 10 to 30 minutes to react and evacuate following a probable magnitude 9 Cascadia subduction zone earthquake along our coastline.

The most cost-effective means of limiting loss of life from locally produced tsunamis is mapping where the dangerous areas are and then implementing a long-term, relentless public education campaign aimed at developing the culture of awareness that will cause people to leave these dangerous areas when they feel a large earthquake at the coast.

Empowering local government in the coastal states to implement this work is the most effective means of solving this problem.

In conclusion, I have just returned from the first International Conference on Urban Disaster Reduction in Kobe, Japan, and participated in two days of work sessions with my tsunami program counterparts from Japan.

Our joint recommendations focused on the need to increase our level of confidence in technology that we rely on, to translate more research into direct application and increase our investment in the culture of awareness.

Considering the history of Japan's tsunami countermeasures, it is validating to see that we have universal concerns about our respective societies' needed direction for higher safety.

The proposed increase in tsunami buoys, coupled with an expanded seismic monitoring network, will greatly enhance our nation's ability to detect and warn of potential distant tsunami strikes.

But the NOAA DART buoy network does not provide adequate warning time for near-shore tsunami. In fact, it is critical not to rely on their warning in the event of a near-shore earthquake since so little time is available for evacuation.

Please understand that supporting each of the Pacific states' tsunami programs is the most effective way to build the culture of awareness necessary for prompt evacuation before local tsunami and for the notification infrastructure necessary to deliver warnings of approaching distant tsunami.

Thank you.

BOEHLERT:

Thank you very much, Mr. Wilson.

For Dr. Groat and General Johnson: Testimony indicated that there is as much as a 20 percent chance of an earthquake as large as last month's occurring on Pacific Northwest coast of the U.S. within the next 50 years.

Does the Pacific Coast of the U.S. face a greater risk from tsunami generated right offshore -- for example, the Cascadia subduction zone -- or from those generated from farther away?

If the greater danger is closer to shore, to what extent will the expanded detection system the administration is proposing be of assistance?

Dr. Groat?

GROAT:

Coming from a seismic hazard point of view, the threat of a very large earthquake of the kind that you described, close to shore -- and that Mr. Wilson was concerned about how we deal with the impacts of that -- is probably at least as likely as something generated farther away that would come in at great distances. That is a very active, tectonically active part of the plate system.

GROAT:

And as far as the U.S. is concerned, with the exception of a smaller area in the Caribbean, is the area we need to be the most concerned about.

So I don't think we can afford to put all our eggs in one basket. We have to worry about the long-distance tsunamis that the NOAA system is intended to provide warnings about and find measures that Mr. Wilson described to deal with the very real likelihood that a large earthquake on that plate boundary will happen within a foreseeable time and provide the adequate measures to respond to that.

BOEHLERT:

So the sophisticated technology that we've all been talking about wouldn't have time to be operative there. You've got to have a good education system, which speaks to the nature for a comprehensive system, not just buoys someplace out there in the Pacific or down in the Caribbean, but we've got to have a good education system so that the Tillys of the world can see something and understand what's happening.

General Johnson, do you want to address that?

JOHNSON:

Yes, sir.

I agree 100 percent. When you have the earthquake trigger, the tsunami wave is generated and goes both ways. And if it's right off your coast, it comes towards your coast and you have those precious minutes with which to react. That's way I agreed that an education program has to be part of a comprehensive end-to-end system.

If you buy a buoy, you've got a buoy. If you buy a system, an end-to-end system, you have education that will enable people to react in those precious early minutes.

BOEHLERT:

Then why does just about all our resources go to buoys?

I mean, if I see one deficiency -- and I don't want to say a deficiency -- but I think there should be some more emphasis in the comprehensive plan on education than there is.

We applaud the emphasis on technology. You might expect that from the Science Committee, and that's critically important. But there has to be something more in the area of education, as Mr. Wilson points out.

JOHNSON:
Sir, I agree that education is a very important part. But you'll note that water is a very efficient transmitter of energy.

And the tsunami-generation zones are the Pacific Rim in its entirety. And we are in fact part of the entire planet, and things that happen over there can affect us here.

So having sensor systems over there, as well as here, make us part of a comprehensive worldwide program.

We also need to pay attention to the Atlantic and the Caribbean as well (OFF-MIKE) probability of occurrence, but with potentially devastating consequences.

BOEHLERT:
Well, can either of you, then, shed some light on what the plan is in education? Is there sufficient evidence to indicate that we're giving it proper attention?

JOHNSON:
I think a lot of people -- I'll take that first and answer -- I think a lot of people have tsunamis in the middle of their crosscheck right now. My concern is as time goes on people will lose that awareness.

I think we need to codify the National Tsunami Hazard Mitigation Program, get the hazard inundation mapping accomplished so we know where we can go when we decide to evacuate. We need to build the systems now to enable us to detect those trigger events and tell people that they do need to evacuate. We need to be able to communicate that to people.

And if it happens on the Cascadia fault zone, it's very probable, Mr. Chairman, that a lot of the infrastructure that we're depending on could be adversely impacted by the earthquake itself. I mean, the radio towers and those kinds of things that would help us disseminate those words may or may not be operational at that point.

So I think a comprehensive system that includes the readiness program is certainly part of a prudent system that this nation ought to adopt.

BOEHLERT:
But the plan advanced thus far -- and I, once again, let me say, I applaud the administration for its initiative and I'm going to be fully supportive and then some.

JOHNSON:
Yes, sir.

BOEHLERT:
But how about education in general? What amount of those resources...

JOHNSON:

I've got $1.5 million in the proposal to cover inundation mapping, the TsunamiReady program and outreach.

So this is a level of effort thing. If additional dollars are available, we could do additional mapping and have...

(CROSSTALK)

BOEHLERT:

Does that pass the test of adequacy? $1.5 million in this town is tip money.

I mean, I don't mean to boast as a big spender. And, you know, to heck with what anybody else says, you're going to deal with this program, because it's in my zone of interest, and you're going to provide some adequacy and funding. But $1.5 million.

JOHNSON:

$1.5 million in '07 and then a $1 million sustained through the out-years, sir, that is the current proposal.

BOEHLERT:

OK. Well maybe we can take the current...

JOHNSON:

I'm sorry, I misstated. That's '05 and '06, and then '07 beyond would be the $1 million sustained.

BOEHLERT:

Dr. Groat, you want to add something?

GROAT:

Yes. I think Mr. Wilson made an eloquent case for the most effective way to educate people in areas at risk, and that is by providing state and local governments with the resources necessary to do exactly the kind of work that he outlined.

The federal government can play a role in getting those funds to the right people. The actual education effort comes best from those in the affected areas.

And it's our responsibility, I think, to make sure that the resources and the technical information that they need to make those plans is available. Because they are the continuity, they are the ones that keep things moving.

The difficulty with natural hazards is we forget between events.

BOEHLERT:

We really have 15 communities there are tsunami- ready...

GROAT:

Exactly.

(CROSSTALK)

BOEHLERT:

... identified.

And in all fairness to people at state and local government who say we keep getting these instructions -- mandates, if you will -- from Washington and they're in our enlightened self-interest to address them. But where are we going to get the resources?

GROAT:

The resources are critical, Mr. Chairman, there's no question.

And unless the emphasis is put on those resources that go for that purpose, it's going to be difficult to do. Because they are as resource-dependent as the rest of us are.

And Mr. Wilson may have some thoughts about the best way to make that happen.

WILSON:

Thank you, Dr. Groat.

Mr. Chairman, we are currently embarking on a pilot program in the city of Seaside, Oregon. And it's a new approach that we're trying to do, public community outreach at a very grassroots level.

We've gotten funding through the National Tsunami Hazard Mitigation Program and FEMA to hire a person who is working a little over half-time as an on-the-ground coordinator.

We're doing surveys before and after an outreach program that we're conducting to try and assess just how effective our messaging and outreach capacity is, to try and develop a more model approach to other communities on the coast.

But I think what we're finding in this pilot program is -- the outreach tools that we have in place are effective, but what we don't have is the person on the ground to do the face time with the local community, someone who's there, someone who can basically do a block- by-block type awareness campaign.

I think, you know, there's a lot that comes out of the national funding that promotes the warning system and even the infrastructure for disseminating an alert, but it's really on the ground that people have to know what to do. They have to rehearse these drills during the daytime so at 2 in the morning, at night they know where they need to go.

There's so much that we try to help our locals with on the ground when they all have limited resources.

BOEHLERT:

My time has expired. And I'm going to try to stick to the time limit so we give everyone an opportunity to ask questions.

Lets go to Mr. Gordon.

GORDON:

Thank you, Mr. Chairman.

As usual, I think you and I are headed pretty much in the same direction.

As I said earlier in my statement, I support the goal of this program, and I also want to applaud the swiftness in which the administration has brought this to us.

But I've got two concerns about the proposed budget.

First, we've had -- little information has been provided about the funds needed to sustain a functional end-to-end tsunami warning system once it is built.

And second, what are the offsets for the additional spending in the president's proposal?

Dr. Orcutt and Dr. Lerner-Lam both expressed a concern about the sustainability of funds for annual operation and maintenance costs to the system. And additionally, Dr. Orcutt indicated a current operation and maintenance shortfall of the GS network of about $5 million.

So Dr. Groat and General Johnson, what are your estimates of the annual operation and maintenance of the system?

And when I say that, I'm not trying to get you in trouble, but what I'd like to do is ask you, you know, what is a realistic budget, not what has been budgeted?

And I say that because if we are to seek additional funds, we would like to do this in an informed way.

GROAT:

Speaking on behalf of the seismic network as, Dr. Orcutt mentioned, there is a need for investment in additional instrumentation. But as you pointed out, the need to maintain that instrumentation and keep it current is extremely high, to keep it up and keep it operating.

GORDON:

Yes, we've three that aren't working right now.

GROAT:

In the buoy system..

(CROSSTALK)

GROAT:

We have similar problems with our seismometers. They do go down and we have to maintain those. And those of us that operate those systems, both University of California-San Diego and USGS, have difficulty between budget years keeping the funds to maintain the systems adequate.

I'm encouraged, though, Mr. Gordon, in what we know up to this point about the president's proposal for keeping the system fed with funds to maintain the system we've designed in the out-years, '06 and beyond.

Unless we're surprised, I think there will be a recognition that that kind of funding is needed and that we will receive the money necessary to maintain the system that we've implemented.

GORDON:

Would you say that you think that there's an adequate amount being budgeted now, or that you think it will be recognized later and more will be added. I didn't...

GROAT:

No, I think that there is an adequate amount being budgeted now for '06-'07 and beyond to maintain the kind of system that we've described, the incremental addition to it and then the maintenance necessary to make sure that system is functioning in the future.

Now, does it solve all of our delayed maintenance kinds of problems and so forth? Not necessarily.

But unlike some immediate responses to significant events like this, whether it is a big spike in funding and then nothing in the future, and then we do have the very problem you described, there is the recognition that those funds to maintain the system are necessary.

There is the budgeting of those funds. And we're comfortable that we have taken a major step in making sure that happens.

GORDON:

And is that both for mapping and public education rather than just for maintenance of the network?

GROAT:

In our case, it's principally for maintaining the upgraded system at the National Earthquake Information Center. It provides some funds to continue the mapping efforts. It provides some funds to maintain the system that we have now in place...

GORDON:

Some funds or adequate funds?

GROAT:

I think, Mr. Chairman -- I think, Mr. Gordon, that they are adequate funds at the level that the system is being deployed.

Now, I could make some arguments that we need a broader system and a more dense system, particularly in the case of something like the Advance National Seismic System, and it that case any surge of funds to build the instruments, put the instruments in place, would need to be matched with additional funds for maintenance.

We have not requested nor are we anticipating receiving that level of funding at this time.

GORDON:

I'm concerned on a couple of things, one, that you apparently don't have adequate funds now for maintenance or you would be -- when I say doing a better job, I mean, I'm not trying to -- you can only do what you have funds for, but apparently it's not being adequately performed now, and I'm concerned about that.

I'm also concerned about -- is this going to result in additional offsets?

And, you know, for example, with tornado warnings system now -- I mean, I think there are some technologies out there that you know about -- if it was brought on board it would give us a better system for technology, but you can't afford to do that.

So, you know, are we just making a difficult and inadequate budget worse with this?

GROAT:

I'll turn it over to General Johnson in just a second for the NOAA's point of view.

From our point of view, with the seismic systems, the interpretation of data, the dissemination of data, the increased funds to do that more adequately and to maintain

that, we don't anticipate at this time that we will have to offset other programs to make that happen.

GORDON:
Good.

JOHNSON:
With regard to NOAA and the sustaining of the buoy and tide gauge network, as well as the inundation mapping, we have programmed money to acquire them using the '05 supplemental and the '06 president's budget top-line increase.

For the '07 to '11 timeframe, NOAA is going through that budget process right now. I've got commitments from Admiral Lautenbacher to address the tsunami tail to sustain that.

I've already highlighted to him that it's $3.75 million for the buoys, a quarter-of-a-million dollars for the tide gauges and ongoing...

BOEHLERT:
$3.7 million to the buoys?

JOHNSON:
Yes, sir.

BOEHLERT:
To acquire new ones?

JOHNSON:
No, sir, to maintain a 25-buoy array in the Pacific, which will be installed in the beginning of '07.

BOEHLERT:
What we have right now is...
(CROSSTALK)

JOHNSON:
We have six right now.

BOEHLERT:
We have six buoys in the...

JOHNSON:
Yes, sir...

GORDON:
... in the Pacific now. Three of them are not operative.

JOHNSON:

Right.

BOEHLERT:

Now, I'm a baseball fan. If you bat 500 in baseball, you're doing pretty good.

There's a little place in my district called Cooperstown where I can get you admission if you bat 500.

But when only three of six are working, functioning properly right now in a warning detection system, that doesn't get you in anybody's hall of fame.

JOHNSON:

Yes, sir.

They're the first six going to an eventual 29-buoy array.

They're transitioning from the research and development phase into operations. And you're right, we have three of them that are down right now.

JOHNSON:

Can I have backup slide 11?

GORDON:

And I assume they're down because of the money to have the ship time to go out and take of them.

JOHNSON:

No, sir.

Some of the problem revolves around having a -- we had one buoy that had a battery problem out here, and when we went out to service it and pick it up, the cavity in the buoy had an overpressure indication and we had a little explosion on the buoy.

We're in the process -- we had a safety stand-down. We modified the six other buoys to have a pressure relief valve.

We also came across some water intrusion into cabling on the new buoys and are in the process of upgrading cables. That's this damage right here.

And then people from that part of the Pacific will tell you that from about November to about March, weather is definitely a hazard.

And to bear that out, in December we went out to service a buoy in conditions that were marginal. We felt the need to pursue that before this event happened. We were out there to service it, and actually dinged one of the buoys because of the condition of the seas.

So NOAA is not sitting back. We're actively trying to transition these into operations and build the redundancy that was brought up earlier in those areas were weather is going to be a persistent factor.

GORDON:

Thank you.

Any other witnesses want to make a quick, very quick comment on any concerns about any cannibalizing of other programs in terms of being adequately able to do the operation and maintenance with the funds proposed?

JOHNSON:
I might just comment briefly.
The part of the world that Eddie Bernard here is working in at the moment is one of the worst possible places to try to do this job. The weather is terrible there almost all the time, and it's asking a great deal of these small buoys to perform at 100 percent times.
So the weather is certainly something that has a great deal going against you in that environment.
But the issue is whether there are sufficient funds in the long term, and in a way we can answer that after FY '07. But the costs are significant.
You can replace the capital investment in a matter of a few years because of the maintenance required.
May I make one additional point, Mr. Chairman?

BOEHLERT:
Sure, General.

JOHNSON:
The current buoys are kind of the first generation. And we envision deploying a second generation that will enable two-way communication, include some of the reliability and maintaining improvements to Dr. Bernard's great design that has already proven its worth.
So when we build the new system it should be a much better system that has the built-in redundancy.

BOEHLERT:
Thank you.
Ms. Biggert?

BIGGERT:
Thank you, Mr. Chairman.
General Johnson, then you would probably say that the problem with the buoys could be with the contractor, with the technology and with funding -- all three of those together?

JOHNSON:
I think that NOAA experiences challenges when we transition good ideas from research and development into things that are going to be operationalized and, you know, routinely counted on for long periods of time.
You know, in a perfect world we'd be able to service the buoys once a year and be done with it and have nothing go wrong.
And with the next-generation buoy. we're looking at having some built-in test indicators, some additional redundancies and those kinds of things.

BIGGERT:
Thank you.

Let me, then, just move to another question.

On December 26th, I think it was reported that two U.S. tsunami warning centers knew of the high likelihood that a tsunami had been generated, given the magnitude of the earthquake.

Why wasn't that reported immediately to the State Department or someone who could do something, to inform them so that other nations would know that they were in danger?

JOHNSON:

The Pacific tsunami warning system worked as it was designed, which was to alert the 26 member-nations of that consortium of the possible impact.

Now, the Pacific tsunami warning center is right there in Hawaii, and they also, when they became aware that there was a tsunami wave associated with the earthquake, did take steps to do additional notification.

I would hasten to point out that many times significant earthquakes do not generate tsunamis. That's one of the reasons we need to do some more modeling effort and work with our colleagues over at USGS to understand the why-fors and the how-comes there.

But at the time, ma'am, when we figured out through press reports -- because we were blind because we had no sensors in the Indian Ocean; there was no possibility of knowing at that point whether the wave was associated with a big earthquake or not -- it was already past Indonesia and Thailand and Sri Lanka and was doing the east coast of India. And the next big landfall was Diego Garcia, and the center did, in fact, call Diego Garcia.

The Pacific Fleet has a significant presence in and around Diego Garcia, and we did have consultations with the State Department's operation center for Madagascar, Mauritius.

And we have instituted and codified that procedure so that now whenever that happens we're notifying the State Department, and we're also putting out notification through the standard World Meteorological Organization weather channels that are well-established to the countries.

BIGGERT:

Let me ask the panel what are the greatest challenges to establishing a global tsunami warning system? And what role should the U.S. play? And does the administration's plan accomplish that role?

(UNKNOWN)

Let me just take a quick shot.

I think the GEOSS process was mentioned, the Global Earth Observing System of Systems, in which the U.S. and 54 other nations play a significant role. I think the administration sees that organization -- which has been pointed out, meets in Brussels on the 16th of February -- as the place to bring the international community together to design perhaps its first truly global system that meets societal needs, which is what the intent of that whole program is.

The U.S. role in that -- Admiral Lautenbacher is one of the four co-chairs -- will be to provide some of the leadership in the technology and the application of that technology.

But as you might expect, as a result of the event on December 26th, international groups all over the world are coming together -- there was a meeting in Beijing just

recently and there is another one in Thailand in a week or so -- to talk about how they in their regions can do this.

The real challenge is going to be to turn this into a true system of systems so that warnings are spread around to the people that need them in an effective way rather than in a fragmented sort of way.

So I think the GEOSS approach, which brings the whole community together, is a real opportunity to bind these systems in truly a system that works for everybody.

BIGGERT:

Thank you.

Anybody else like to comment?

LERNER-LAM (?):

I'll simply add that I agree with those comments. But in my mind, in terms of a global warning system, local engagement is perhaps the least understood component of this.

What do you do with a warning once it is issued?

I think some of the technical and research problems are well on their way to solution. I would merely add that end to end, however, includes everything from the basic research of these great giant events through the operational component all the way to the local engagement.

We've seen some testimony about how that might occur in the United States. A coordinated international plan, however, is lacking.

BIGGERT:

Mr. Wilson?

WILSON:

I just have a quick addition to that.

One of the things we're really working on the Oregon coast is notification to visitors, to tourist. The vulnerability to the tourist in Thailand was a good example of how people who are on vacation, who are not a part of the local culture, are not thinking about their surroundings.

In terms of evacuation in areas that are tourist areas, vertical evacuation versus inland evacuation is something that is being researched and considered.

The types of structures that could survive a local magnitude 9 earthquake and then still be able to provide vertical evacuation for seniors, for the disabled, the people who cannot get out of harms way with a limited evacuation time, I would just say that for a larger more comprehensive tsunami system this is also something that needs to be considered.

BIGGERT:

General?

JOHNSON:

Dr. Lerner-Lam's chart of mortality due to severe environment effects was telling. The United States was a conspicuously non-shaded area. We on average experience 10,000

severe thunderstorms a year, over 1,000 tornadoes. We set a new record this year for 1,700 tornadoes and we usually experience about 6 hurricanes a year.

BIGGERT:
Makes flying to Washington very difficult sometimes.

JOHNSON:
Yes ma'am, and for that I apologize, on behalf of the Lord.

However, the reason that is an unshaded area is because we have an integrated data-sharing system between all the different sensor networks, not only for tsunamis but for weather events, and this is the kind of benefit that our planet needs.

The GEOSS is the tool to address not only tsunamis but severe weather and environmental effects worldwide.

We've got a wonderful opportunity with the attention of the world focused right now to capitalize on this opportunity.

Thanks.

BIGGERT:
Thank you.

Thank you Mr. Chairman.

BOEHLERT:
Thank you.

General Johnson, just out of curiosity, going back through recorded history, is there any time when an earthquake of the magnitude of this one, 9.0 on the Richter scale, did not cause a tsunami?

JOHNSON:
Not all earthquakes cause tsunami. It depends on the magnitude.

BOEHLERT:
But has there ever been any point in history when something of this magnitude failed to result in (inaudible)

JOHNSON:
Yes, I think USGS has some examples of things that happened just weeks before the tsunami event.

But it's very complicated. You know, you have to be off the coast, it needs to be in the water. Usually it's created because of that up-thrust in the subduction zone or maybe a meteorite or maybe a landslide, that kind of a thing.

BOEHLERT:
But the simple answer to my question is yes, depending on the circumstances, or...

GROAT (?):

I think if there were a 9 earthquake of the mechanical type that General Johnson mentioned, with the thrusting in an ocean basin margin, and the likelihood is almost 1 to 1 that it would generate a tsunami.

Part of our record in the past, while through mapping of deposits on coasts where tsunamis have brought those deposits on the shoreline, is that we don't have the comparable record of the exact earthquake event that caused it and therefore don't know the magnitude.

So there's not necessarily something magic about 9; it could be a smaller earthquake. I mean, 8s or 7.5s could possibly generate tsunamis of significant...

BOEHLERT:
When did we know it was 9?

GROAT (?):
When?

BOEHLERT:
Yes.

GROAT (?):
It took awhile, because, again, back to our seismic station density. Certain waves -- the surface waves have to get to you to do the kind of analysis that's needed to make...
(CROSSTALK)

BOEHLERT:
Minutes? Hours?

GROAT (?):
Hours, in some cases.

We get the early waves and we get a preliminary analysis and we generated an assumption that it was in the neighborhood of an 8. It wasn't until the surface waves arrived at enough stations that we could interpret that data, which was a matter of at least an hour -- wasn't it...
(CROSSTALK)

JOHNSON:
It was an hour and 5 minutes later, Mr. Chairman.

GROAT (?):
An hour and 5 minutes that we knew it was a 9.

JOHNSON:
8.5.

GROAT (?):
Sorry, 8.5, yes, 8.5.

JOHNSON:
We updated it, and it was actually academic institutions and much later that it turned out to be 9.

BOEHLERT:
I can understand what was happening is, maybe a lot of people doing a lot of things, but why seven hours to notification to the State Department?

JOHNSON:
Sir, it was a long time before we had high confidence that there was a wave associated with it.

BOEHLERT:
So you didn't want to give a false alarm.

JOHNSON:
We experienced -- from the formation of the Pacific tsunami warning center in 1949, we had a 75 percent false alarm rate. After the inception of the buoy system, we have a very small sample size but we don't have a false alarm rate to date.
Yes, sir, there is a high probability that there is a tsunami wave associated with an earthquake of that magnitude, but it isn't a complete certainty. I think my guys were waiting to get some indications of that fact.

GROAT (?):
Just to point out, Mr. Chairman, that certain types of earthquakes that are generated by slippage this way can be very large, can be 8s or so, in coastal areas and don't generate tsunamis.
So we really do have to have that complete analysis of data that is enhanced by a more dense system, more real time data to provide that kind of information that it is or isn't tsunamigenic as quickly as possible.

BOEHLERT:
Which argues for more investment technology.

GROAT (?):
Yes it does in that case, yes, sir.

BOEHLERT:
Mr. Wu?
WU: Thank you, Mr. Chairman.
I would like to follow up on some of your questions and the ranking member's questions.
I have great respect for the professionalism of all your people, but I have to ask the obvious question: The fact that this earthquake occurred at roughly 8 p.m. Eastern

Standard Time on Christmas Day, did that have anything to do with slowing down the notification process?

JOHNSON:

Sir, I was very lucky, I had a very dedicated guy who was in the office at 3 p.m. Honolulu time, or 2:59, and that is why we were able to get the message out to the member-countries as quickly as we did. It was three minutes before he got the initial message out after his notification. So it was very timely.

Now, with the proposal that the administration has made that we increase to 24/7, we're not 24/7 right now. We're one shift during the day, and then we've got beepers on people. And I've kind of set up a five-minute response time to get in the office and be able to send the preloaded messages, if an event happens.

But we are taking this opportunity in funding to remedy that situation, sir.

BOEHLERT:

Does anyone else have anything to add to that?

ORCUTT (?):

I'd just like to comment, its been mentioned a bit before, but I think today it's possible to bring a awful lot of this together more closely, using modern information technology to do these things.

One of the reasons for recommending satellite telemetry is so that the latency in deliver of data to the NAIC, for example, is in the order of a few seconds. That kind of latency ought to also characterize communications with the center in NOAA, with many people, including academia, that are also involved in these things. The magnitude 9 did come from an analysis in fact I believe at Harvard.

These things ought to be linked more closely together to reduce that length of time that we have here -- an hour, an hour and a quarter -- for notification to something that is on the order of substantially less than an hour.

The more seismic stations can mean you might be able to get this job done in 15 minutes, but that's in a very, very ideal sort of world.

But the GEOSS that was mentioned is a good way to coordinate this effort internationally.

WU: Thank you very much.

And I want jump very quickly to a different topic, because I'd like to get two questions in. One is the follow-up on the set of questions earlier from both ranking member and the chairman about the appropriate balance between education and investments in new technology.

Mr. Wilson, General Johnson, Dr. Groat -- one of the biggest threats to our country, in terms of tsunami threat, is off the shore of Oregon and Washington. The subduction fault is very close at hand.

And while I completely agree with General Johnson's comment that we should be part of a worldwide integrated system, and that's absolutely crucial, I am concerned that we have an appropriate balance between education of folks on the West Coast so that they can react to an immediate event, as opposed to giving, say, the Japanese warning of a 10-foot wave nine hours later, you know, a 50-foot wave coming up on the Oregon shores

within 10 minutes, for parochial reasons if no other -- you know, I am very concerned about that.

Can you all address the appropriate balance in our budget between the investments in buoys and technology and electronic warning systems and sort of sometimes the harder-to-defend and harder-to-get dollars, if you will, for soft things like education, which may prove absolutely crucial when you've only got 10 minutes from the event to water coming on shore.

WILSON:

I would just like to respond to that, Member Wu, because since I've been in this position, I've had to deal with the concern for false alarms along the coastline too.

And because we communicate that when people feel localized earthquakes along the coast -- like a pair of earthquakes that were off shore this past summer, along the Oregon coast -- I had people in a small town of Waldport, at 11 p.m. when they felt a magnitude 4.5, you know, running out of their house because they were afraid this was it.

And, you know, the ability to get an all-clear transmitted to people so that they understand that this --- they responded correctly -- but this isn't a tsunami-producing earthquake.

That's still a level of technology and a level of confidence that we need to work for delivery to the people. It's the opposite end of giving them an accurate warning; we also need to be able to give them an accurate all-clear.

JOHNSON (?):

I appreciate the question, because it allows me the opportunity to fix something.

The numbers of a million and a half I spoke earlier were specifically for just the Pacific side. On the Atlantic-Caribbean Gulf side we have additional dollars. So the total, Mr. Chairman, is $2.75 in '05 and $2.5 then straight-lined through the out-years -- for education, inundation mapping, modeling efforts and the very important education outreach.

WU: And, Mr. Chairman, if you could indulge me one last question. I think it's...

BOEHLERT:

Pleased to indulge my distinguished colleague.

WU: Thank you very much, Mr. Chairman.

This is of great importance to I think to everybody on the West Coast, and I take a great interest in it as I've spent a lot of time in the coastal parts of my congressional district.

I was looking at those inundation maps, and if I'm just driving along highway 101 and something big happens, how high do I have to get, how high do my constitutes have to get, how far inland do they have to get -- that's something I've never quite known.

GROAT (?):

Well, that certain level of responsiveness is different in nearly every locality there, based on the defimatry (ph), the offshore topography, the local topography, the directionality.

It really emphasizes why the site-specific modeling has to be done.

We can't just go down the coast and draw a line at a 50-foot contour with any accuracy.

As we've seen in Aceh -- and we're just learning. There were areas in there that exceeded that.

So we're still trying to make our evacuation mapping as accurate as possible for people. We would hate to tell people they only have to go to 50 feet when in fact it may be worse than that.

WU: More research...

GROAT (?):
More research.

LERNER-LAM (?):
And additionally you don't get one wave. You get multiple, successive waves. And this is at a time where communication and infrastructure may be damaged.

So this awareness issue that the emergency managers bring to the end-to-end system is crucial, because you need to know when you can go back, because as we saw in this event, sir, there was about an hour spacing in between and five huge waves -- Is that the last one? How do you know?

BOEHLERT:
Mr. McCaul?

WU: Thank you very much, Mr. Chairman.

MCCAUL:
Thank you, Mr. Chairman.

Thank you distinguished panelists.

I had a question about the -- for Dr. Groat and General Johnson -- with respect to the $37 million the administration has proposed.

Can you, in a very general sense, tell me where that money is allotted with respect to a warning detection system, both to protect the United States but also in a global sense?

We've talked a lot about GEOSS. Do you need that money going towards a global warning system?

GROAT:
From the seismic aspect of this, a small amount is going to the global perspective in that we intend to bring, from 80 percent to 100 percent, the real-time transmission of earthquake information from the global network.

And also the money that is being put towards upgrading our National Earthquake Information Center, to bring modern hardware and software there to enhance the processing of both global and domestic seismic information, will have the dual benefit of helping the United States in both earthquakes and tsunami concerns, but also, that information would be available in a global sense shared with others. So it has that dual role.

And as far as the maintenance support for that system as well as for the global seismic network, particularly including the Caribbean, that, again, has some global aspects, but it benefits chiefly the United States and its interests.

So our focus is on the United States. But in upgrading the Global Seismic Network's real-time capability and the processing of data from that, it will have some global impacts that are positive as well.

JOHNSON:

I view this as a two-tier approach: one, is taking care of national concerns and the other is applicability and to sharing into the larger Global Earth Observation System-of-Systems, where 100 percent of it goes towards protecting U.S. coast.

It allows you to characterize the extent of the wave, the height of the wave, the propagation of the wave as it transfers up the coast, up toward the Aleutians, if that were to happen at the Cascadia and elsewhere, into Hawaii, into American Samoa, into our obligations.

And because we need to defend America, or be able to detect it on all of our coastlines, it allows us, as a by-product, but it allows us to share that data, as Dr. Groat says, with the rest of the world.

And we benefit from them. The tsunami that happened off of Sumatra, 26 hours later, gave us a 20-centimeter rise in San Diego, 26 hours later.

So there is benefit in sharing information.

Now, that's not of big consequence at this point, but depending on where it happens, it's valuable to have data shared from around the world, sir.

MCCAUL:

And my second question is, what is the time frame for implementation, and will this be tied to more comprehensive information system as a whole?

GROAT:

Our plans for implementation are in current year, with supplemental funds, to do that upgrading to 24/7, to the hardware/software upgrade, and to maintain it with out-year funds. And I think General Johnson pointed out, they had '07 plan for their system implementation. So it's sooner than later.

JOHNSON:

Yes, sir, '05 and '06, I'm viewing to have '07 as the implementation for the entire buoy and (inaudible) program.

MCCAUL:

Will that be tied to a comprehensive information system as well?

JOHNSON:

It'll be linked in through the centers, through the Pacific tsunami warning center and the backup in Alaska that are mutually redundant, and then that information shared out through the information grids to all member-countries, to America, and then we'll share that data through GEOSS to the rest of the world.

MCCAUL:
And lastly, for Dr. Lam -- I come from a Gulf Coast state, the state of Texas. My constituents will want to know of any sort of risk, either to the Gulf Coast states or the Caribbean states, if you could maybe just highlight what risk there is, if any, of this type of disaster.

LERNER-LAM:
Well, you have a multiple hazard risk. There is potential for these sorts of large earthquakes, based on the work that the U.S. Geological Survey has done in the Caribbean.

So certainly the Caribbean states have some history, both from the geologic record and the historical record of having tsunami risk.

There is not that history in the Gulf Coast. However, of course, you have a meteorological hazard in the Gulf Coast. So one thing to emphasize is that by linking, in some sense, the hurricane preparedness efforts, as well as the tsunami preparedness efforts, there may be some economies of scale on that point. So in the rare instance that an extreme event happens or a landslide off the coast happens, you could be prepared.

MCCAUL:
So in other words, a warning detection system would help with respect to other disasters that could occur.

LERNER-LAM:
As well, yes.

MCCAUL:
OK, thank you.

BOEHLERT:
Thank you very much.

And here's the deal: We've got a series votes on the floor, and we're not going to be presumptuous enough to say we can hang around for an hour while we go over there and play congresspeople.

So after Ms. Jackson Lee has her one minute, we're going to adjourn

Thank you all very much for serving as resources.

We will submit some questions in writing to you because we would like some of your opinions.

And, General Johnson, you may be interested in an aside, because both the ranking member and I said, when you said you've got a five- minute response capability, "How do you get there in 5 minutes?" and counsel pointed out that you've got housing right adjacent to the center.

JOHNSON:
Yes, we've got a flop house that the guys stay in, sir.

(LAUGHTER)

(UNKNOWN)
And, Mr. Chairman, I ask for a unanimous consent that opening statements be inserted in the record.

BOEHLERT:
Without objection, so ordered -- and Ms. Jackson Lee for the final word.

JACKSON LEE:
Thank you, Mr. Chairman. Thank you for your kindness.
This is an important hearing. I've just come back from the region and I know many of you or some of you may have had I would call it a tragic opportunity to see the enormous devastation and loss.
Just for the record, the last tsunami with deaths over 10,000 was in 1755 where there was 60,000 people that lost their life.
I would simply say, Mr. Chairman, that this tragedy cries out for action by the Science Committee. I think we could have done better, and I say this because in talking to some officials, there was a reach to the United States. And my understanding was, because there was no buoys present, that you couldn't detect it and therefore give notice or worse (ph). So I think we can do better.
I'd also offer to say to you that NASA's Jason-1 was able to detect some tsunami signals, if you will, but there's no system in place to sort of connect this, or connect.
I think that we can do better by involving NASA teams somewhat out the way, if you will, but that's because we have new technology that you can coordinate.
So I would simply ask that we have an opportunity for engagement.
And if the general can answer or just say -- can we, General Johnson, look to new technologies and begin to collaborate with other agencies, because I too come from the coastal region.
Thank you, Mr. Chairman.

BOEHLERT:
Thank you.
General, we have to go because we have to make the vote, and we appreciate if you would respond in writing.
And let me say to my distinguished colleague from Texas: That's the whole reason why we're here. We're determined to do better. They are, we are. That's what we do best.
But I'll tell you this also, that while it's in our enlightened self-interest to provide leadership to the world, I'm a little bit concerned that others aren't as actively engaged as we are.
And, you know, it's not just our treasury and our technology -- although we've got to employ everything possible, we've got to get some of the others.
So, Mr. Wilson, the Kobe conference, got to be a follow-through on. Japan has got to start sharing some information with us -- Australia, a lot of other nations involved.
We're all in this together and let's do it together.
With that, the hearing is adjourned.

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